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AD 720968  
Materiel Test Procedure 3-4-005  
U. S. Army Arctic Test Center

U. S. ARMY TEST AND EVALUATION COMMAND  
ENVIRONMENTAL TEST PROCEDURE

ARCTIC ENVIRONMENTAL TEST OF GRENADE LAUNCHERS

1. OBJECTIVE

The objective of the procedures outlined in this MTP is to provide a means of evaluating the performance of grenade launchers under arctic winter environmental conditions.

2. BACKGROUND

Engineering tests of weapons are conducted to determine the characteristics and performance of the weapons under various conditions of operation, and to ensure their compliance with specified requirements. Testing in a natural arctic winter environment is used to substantiate or supplement data obtained from simulated tests conducted during the Engineer Design and Engineering Test phase. Testing in the arctic winter environment generally is not authorized until data from simulated environmental tests provides reasonable assurance that the test item will function satisfactorily when subjected to the conditions that would be encountered in the arctic.

3. REQUIRED EQUIPMENT

- a. Appropriate Arctic winter uniforms.
- b. Weapons as required.
- c. Ammunition as required.
- d. Standard American targets.
- e. Vehicles as required.
- f. Support aircraft.
- g. Drop zone.
- h. M1950 Parachutists individual case (or latest standard containers).
- i. All general and special tools and ancillary items required to perform maintenance on the test item.
- j. Test equipment as required.
- k. Photographic equipment (black and white or color).
- l. Meteorological support instrumentation.
- m. Rate of fire recorder.
- n. Stop watch.

4. REFERENCES

- A. AR 705-15, Operations of Materials Under Extreme Conditions of Environment.
- B. AR 705-5, Army Research and Development.
- C. AR 70-8, Human Factors and Social Sciences Research.
- D. AR 70-10, Army Materiel Testing.
- E. AR 750-6, Maintenance Support Planning.
- F. USATECOM Regulation 705-2, Documenting, Test Plans and Reports.
- G. USATECOM Regulation 350-6, Training in New or Modified Equipment and Training Devices.

- H. MTP 3-2-504, Safety Evaluation - Hand and Shoulder Weapons.
- I. MTP 4-4-005, Grenades and Grenade Type Ammunition.
- J. MTP 10-4-500, Arctic Preoperational Inspection, Physical Characteristics, Human Factors, Safety and Maintenance Evaluation.

5. SCOPE

5.1 SUMMARY

The procedures outlined in this MTP are designed to determine and evaluate the functioning characteristics of grenade launchers under arctic environmental conditions.

The specific tests to be performed and their intended objectives are listed below:

a. Preoperational Inspection and Physical Characteristics - This test provides for an inspection of the test item to:

- 1) Identify damage received during shipping and handling.
- 2) Determine its physical conditions.
- 3) Determine if the test item dimensions, weight and characteristics conform to applicable criteria.
- 4) Locate any defects.

b. Firing - The objective of this subtest is to determine the accuracy of grenade launchers under arctic winter environmental conditions.

c. Position Disclosing Effect - The objective of this subtest is to determine and measure the position disclosing effect created by the cumulative smoke and muzzle flash and sound of the test launchers operated under arctic winter environmental conditions.

d. Functional and Operational Suitability - The objective of this subtest is to determine the ease of carrying and transporting the test launcher across country and over ski trails while wearing snowshoes and skis.

e. Aerial Delivery - The objective of this subtest is to determine the suitability of grenade launchers for Phase I airborne operations under arctic winter environmental conditions.

f. Human Factors Engineering - The objective of this test is to determine if all accessories and components of the test weapons enable easy operation by test crews wearing the appropriate arctic winter uniform.

g. Maintenance Evaluation - The objective of this test is to determine if the test weapons meet maintenance and maintainability requirements as defined by QMR, TC, MC, or other established criteria under arctic environmental conditions.

5.2 LIMITATIONS

The procedures described in this MTP are limited to the testing of grenade launchers under Arctic Environmental conditions. Procedures for normally testing grenades and grenade type ammunition are described in MTP 4-4-005.

6. PROCEDURES

## 6.1 PREPARATION FOR TEST

a. Since arctic winter environmental tests are normally scheduled from October through March (6 months), ensure that the test items, test comparison and support weapons are delivered to the Arctic Test Center prior to 1 October.

b. TDY personnel shall be used to augment assigned personnel and shall be trained to the degree that they are as proficient on the individual weapons as the troops who will use the weapon.

c. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), and Technical Characteristics (TC), and record this criteria in the test plan.

d. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same type of equipment, and familiarize all test personnel available for reference.

e. Record the grade, MOS, background, and training of all test personnel and ensure that all personnel receive new equipment training (NET) as referenced in 4G.

f. Record the following information:

- 1) Nomenclature, serial number(s), and manufacturer's name of the test items.
- 2) Nomenclature, serial number(s), accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

g. Select test equipment ideally having an accuracy 10 times greater than that of the function to be measured.

h. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation.

i. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test. MTP 3-2-504, Safety Evaluation - Hand and Shoulder Weapons must be completed.

j. Outfit grenadiers in appropriate arctic winter clothing as described in MTP 10-4-500, and with individual field equipment, during all weapon testing.

k. Ensure that when not in use, all test weapons, control weapons and ammunition are stored and maintained in an unsheltered area and exposed to ambient air temperature and prevailing weather conditions.

l. Record the prevailing meteorological conditions during the storage phase, as well as test conduct, to include:

- 1) Temperature
- 2) Humidity, relative or absolute
- 3) Temperature gradient
- 4) Atmospheric pressure
- 5) Precipitation

- 6) Solar radiation
- 7) Wind speed and direction
- 8) Frequency of readings
- 9) Source of data

## 6.2 TEST CONDUCT

NOTE: When conducting individual weapon test involving several subjects, samples and conditions i.e., range, temperature position, etc., a "Latin Square" or comparable test design procedure will be imposed to assure a representative distribution of variables and minimum biasing.

### 6.2.1 Preoperational Inspection and Physical Characteristics

a. Upon receipt, carefully inspect all test items and comparison weapons and their shipping or packaging containers for completeness, damage and general conditions in accordance with the applicable section of MTP 10-4-500.

### 6.2.2 Firing Tests

#### 6.2.2.1 Accuracy

- a. Cold soak all test and comparison weapons for at least 24 hours.
- b. Install standard grenade targets at ranges of 100, 150, 200, 250, 300, 350 and 400 meters.
- c. Zero all test rifles with the launcher attached (empty) at a range of 200 meters. Record any difficulties encountered.
- d. Fire three 10-round shot groups at 200 meters with the test launchers empty.
- e. Fire three 10-round shot groups with the test launchers loaded. Note and record the effects of launcher attachment on the zero of the rifle.
- f. Re-zero the launchers at 200 meters. Fire each rifle 40 rounds semi-automatic and 40 rounds automatic. Record the adverse effects of rifle firing on the zero of the launcher.
- g. Order five test grenadiers to fire three 5-round shot groups with the test launcher from the supported prone position at ranges of 100, 150, 200, 300, 350 and 400 meters at silhouette targets.
- h. Record the following data:
  - 1) Ambient air temperature at time of firing.
  - 2) Wind velocity and relative direction in relation to gunner.
  - 3) Center of impact, mean radius, maximum vertical spread, maximum horizontal spread, and maximum spread at each range.
  - 4) Weapon malfunctions.
  - 5) Number of rounds fired through each weapon.
  - 6) Adequacy of sights.

i. Repeat Steps (f) and (g) above, utilizing comparison (control) weapons.

i. Repeat Steps (f), (g), and (h) above, from the kneeling and standing positions for grenade launcher firing.

j. Repeat firing sequence above, at an ambient air temperature range of from -25°F to -45°F, and again at a temperature range from -45°F to the lowest available temperature.

#### 6.2.2.2 Rapid Fire Employment

- a. Cold soak all test and comparison weapons for at least 24 hours.
- b. Place grenadiers on firing line in standing position with the launcher loaded.

NOTE: Grenadiers should wear arctic mitten set (consisting of finger mittens and shell leather gloves).

c. Order grenadiers to assume prone position (kneeling position for rifle grenades) and fire 10 rounds as rapidly as possible (commensurate with good firing techniques).

d. Time firing sequence from the instant the order is given until the last round is fired.

e. Repeat above firing sequence until 5 grenadiers have fired the test and comparison weapons.

f. Repeat above firing sequence with grenadiers wearing individual combat equipments.

#### 6.2.3 Position Disclosing Effect

a. Cold soak all test and comparison weapons for 24 hours.

b. Mount cameras, perpendicular to the muzzle of the test weapons at a sufficient distance to photograph the flash.

c. Position observers behind each weapon and down range at distance of 100, 200, 300, 400, 500 and 600 meters.

d. Station grenadiers with test launchers along a firing line 300 meters from the targets.

NOTE: Conduct this portion of test under darkened conditions.

e. Order grenadiers to fire 20 rounds. Photograph the cumulative flash from each weapon.

f. Record the following:

- 1) Smoke and flash at firer positions.
- 2) Sound, smoke and flash effects visible to the observers at indicated ranges.
- 3) Annotations to the photographs of cumulative flash with regard to variations to flash during the test.
- 4) Ambient air temperature at test site.
- 5) Light conditions (daylight or darkness).
- 6) Wind velocity and relative direction in relation to gunner.

g. Repeat steps (c) through (f) above, utilizing the comparison weapons.

29 May 1969

h. Repeat steps (c) through (f) above, under daylight conditions but without photographing the cumulative flash.

NOTE: The above tests should be conducted in the temperature range of 0° to the lowest available temperature.

#### 6.2.4 Functional and Operational Suitability

- a. Cold soak all test and comparison weapons for 24 hours.
- b. Inspect each weapon for loose, damaged or missing parts and place in the best possible condition.
- c. Hand carry the test and comparison launchers over one-half of the courses at sling arms for the remaining distance:
  - 1) Snowshoe three(3) miles through dense, snow-covered brush.
  - 2) Snowshoe five (5) miles over open snow-covered (cross-country) terrain.
  - 3) Ski ten (10) miles over cross-country trails.
- d. Dry-fire each launcher a minimum of five times during each of the above courses.
- e. Thoroughly inspect each launcher for loose, damaged or missing parts, and record the following:
  - 1) Damage attributed to environmental effects.
  - 2) Problems encountered while transporting weapons.
  - 3) Damage to launchers due to handling.
  - 4) Temperature at test site.

NOTE: The above tests should be conducted in the temperature range of 0°F to the lowest available temperature.

#### 6.2.5 Aerial Delivery

- a. Cold soak all test and comparison weapons for 24 hours.
- b. Inspect each weapon for loose, damaged or missing parts and place in the best possible condition.
- c. Subject all test and comparison weapons to three parachute jumps under the following conditions:
  - 1) Each parachutist shall be equipped with standard equipment and will jump in accordance with latest TM's.
  - 2) Each launcher shall be packed in an M 1950, Parachutists Adjustable Individual Container (or latest standard container) and attached to the parachutists's person as described in appropriate TM's.
- d. Inspect all weapons after each jump for damage and proper operation.
- e. Record the following data for each jump:

- 1) Altitude and speed of delivery aircraft.
- 2) Ambient air temperature.
- 3) Results of inspections.
- 4) Malfunctions of test and comparison launchers.
- 5) Methods used for attachment of launchers to parachutists.
- 6) Compatibility with parachute equipment.

#### 6.2.6 Human Factors Evaluation and Safety

- a. Conduct all Human Factors and Safety tests in accordance with the applicable sections of MTP 10-4-500.
- b. Conduct these tests concurrently with the operational tests (Firing, Position Disclosure, Functional and Operational Suitability and Aerial Delivery), as described in this MTP.

#### 6.2.7. Maintenance Evaluation

- a. Conduct all maintenance evaluation tests (maintenance and reliability) in accordance with applicable sections of MTP 10-4-500.
- b. Conduct these tests concurrently with the operational tests (Firing, Position Disclosure, Functional and Operational Suitability and Aerial Delivery), as described in this MTP.

#### 6.3 TEST DATA

All test data to be recorded will be as specified in the individual subtests of this MTP.

#### 6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data shall, in general, consist of organizing, marking for identification and correlation, and grouping the test data according to test title.

Specific instructions for the reduction and presentation of individual test data are outlined in the succeeding paragraphs.

##### 6.4.1 Preoperational Inspection and Physical Characteristics

Preoperational inspection and physical characteristics data shall be reduced and presented in accordance with MTP 10-4-500.

##### 6.4.2 Firing Tests

Compare mean radius, percentage of hits, and cyclic rate of fire to weapon specifications for possible deviations due to effects of arctic winter environmental conditions.

##### 6.4.3 Position Disclosing Effect

Compare data obtained from the test launchers to the data obtained from the comparison launchers and also against accepted military standards.

29 May 1969

6.4.4 Functional and Operational Suitability

The operation of the launcher under test in extreme arctic winter conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to the weapons attributed to environmental effects of handling shall be compared with weapon specifications contained in appropriate QMR and TC.

6.4.5 Aerial Delivery

The suitability of the grenade launcher under test for airborne operations under arctic winter environmental conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to and/or malfunctions of the weapons attributed to parachute jumps contained in appropriate QMR or TC.

6.4.6 Human Factors Evaluation and Safety

Human Factors and Safety data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.7 Maintenance Evaluation

Maintenance data shall be reduced and presented in accordance with MTP 10-4-500.



# GLOSSARY

1. Maximum Vertical: Vertical distance between the center of the hole made by the uppermost shot and the center of the hole made by the lowermost shot.
2. Maximum Horizontal: Horizontal distance between the center of the hole made by the shot farthest to the right and the center of the hole made by the shot farthest to the left.
3. Maximum Spread: Distance between the centers of the shot farthest apart.
4. Mean Radius: Arithmetic mean of the distances between the centers of all shot holes and a point of the target called Center of Impact.
5. Center of Impact: Defined as the point at which the algebraic sum of the components of the distances to the center of each shot hole is zero.